Jet Shapes and Energy Flows in Dijet Production

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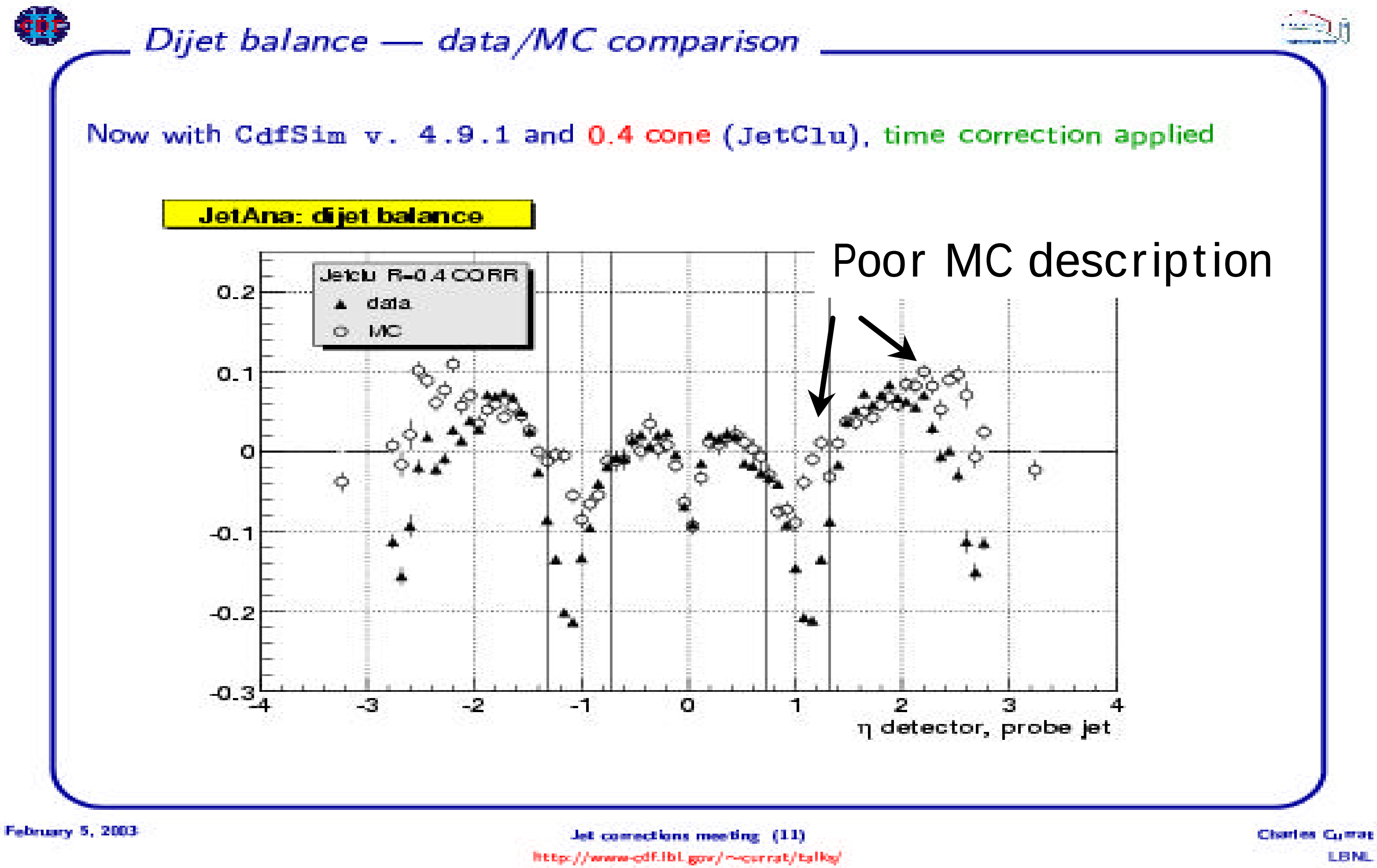
QCD Meeting 14th February 2003
(pre-blessing)

List of Updates w.r.t ICHEP'02

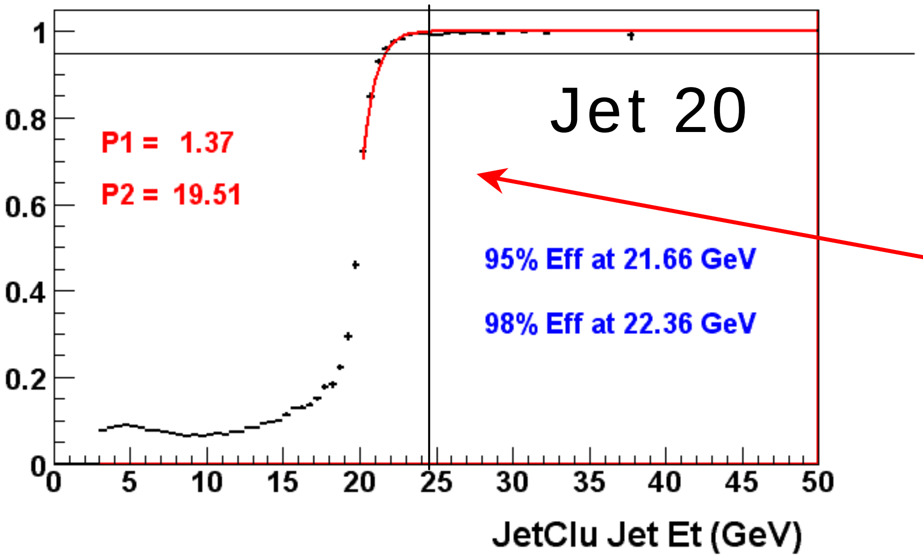
- Using whole Sample of Jet20 and Jet50
  - After QCD Good Run list is applied (77 pb-1)
- Using latest Jet Corrections
  - Relative Corrections
  - Time dependence corrections
  - DO NOT APPLY ABSOLUTE CORRECTIONS
- Remove events with more than one primary VTX
- Latest Version of Data and PYTHIA (4.9.1htp1)

MC/Data Comparison



Maximum correction is ~20% at |η|~1.1

Selection Cuts for Jet20



Dijet Events selection:

$E_T^{jet} > 25\,\mathrm{GeV}$ (uncorrected)

$|\eta^{jet}| < 2.3$

After corrections :

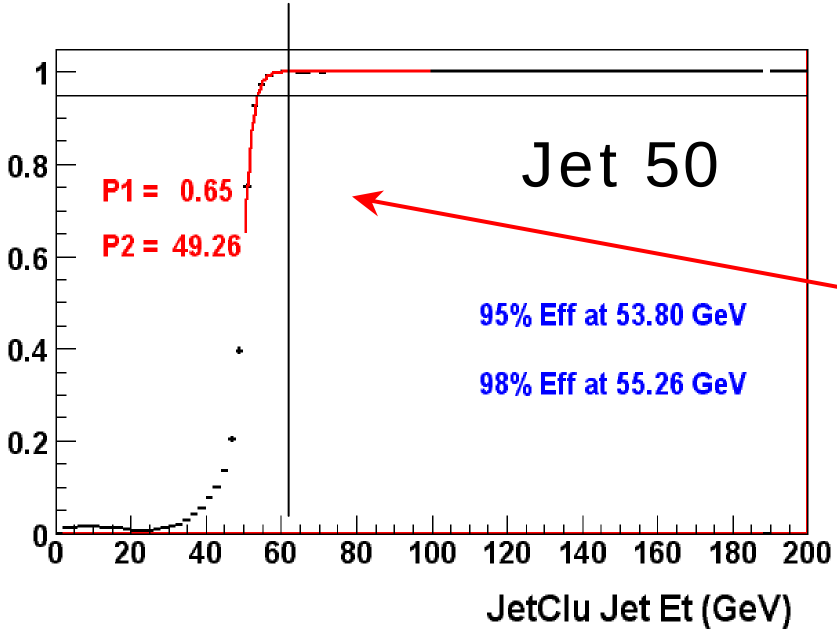
$E_T^{jet} > 30\,\mathrm{GeV}$

Other cuts (same as ICHEP'02)

$\frac{\mathrm{Missing}\,E_T}{\sqrt{E_T}} < 2\,\mathrm{GeV}^{1/2}$ $\quad |V_z| < 60\,\mathrm{cm}$

New Cut against MI : No more than 1 vertex

Selection Cuts for Jet50



Dijet Events selection:

$E_T^{jet} > 60$ GeV (uncorrected)

$|\eta^{jet}| < 2.3$

After corrections :

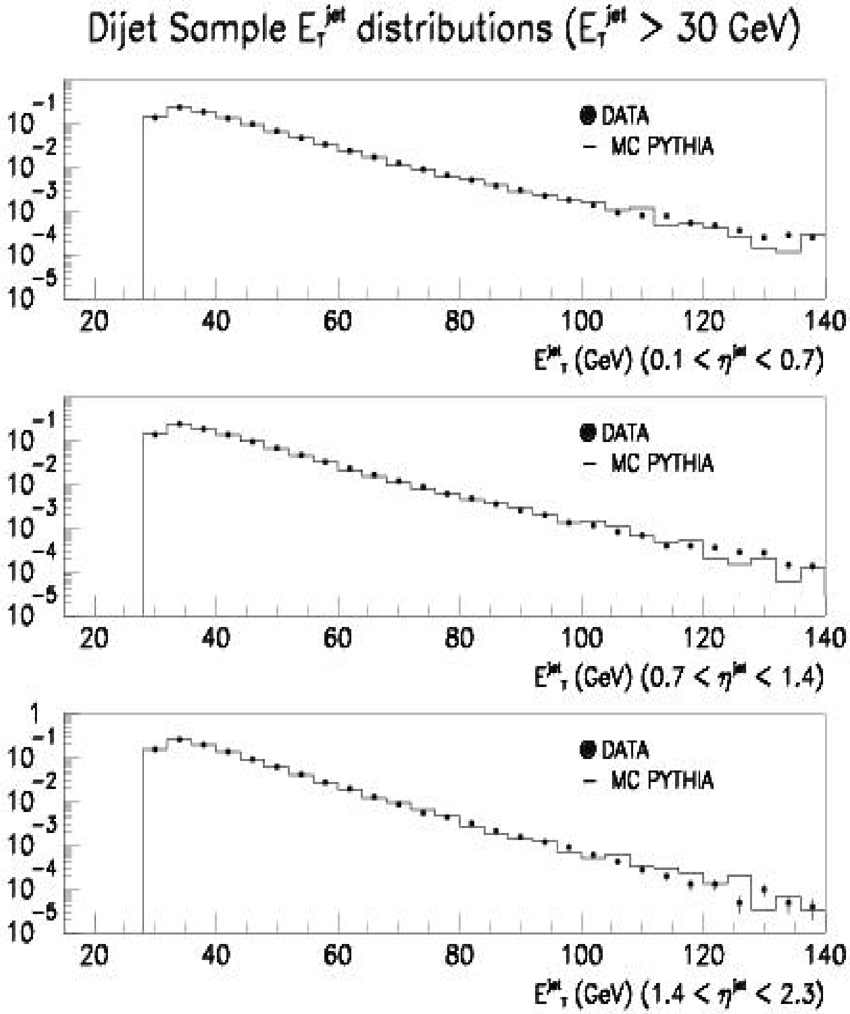
$E_T^{jet} > 75$ GeV

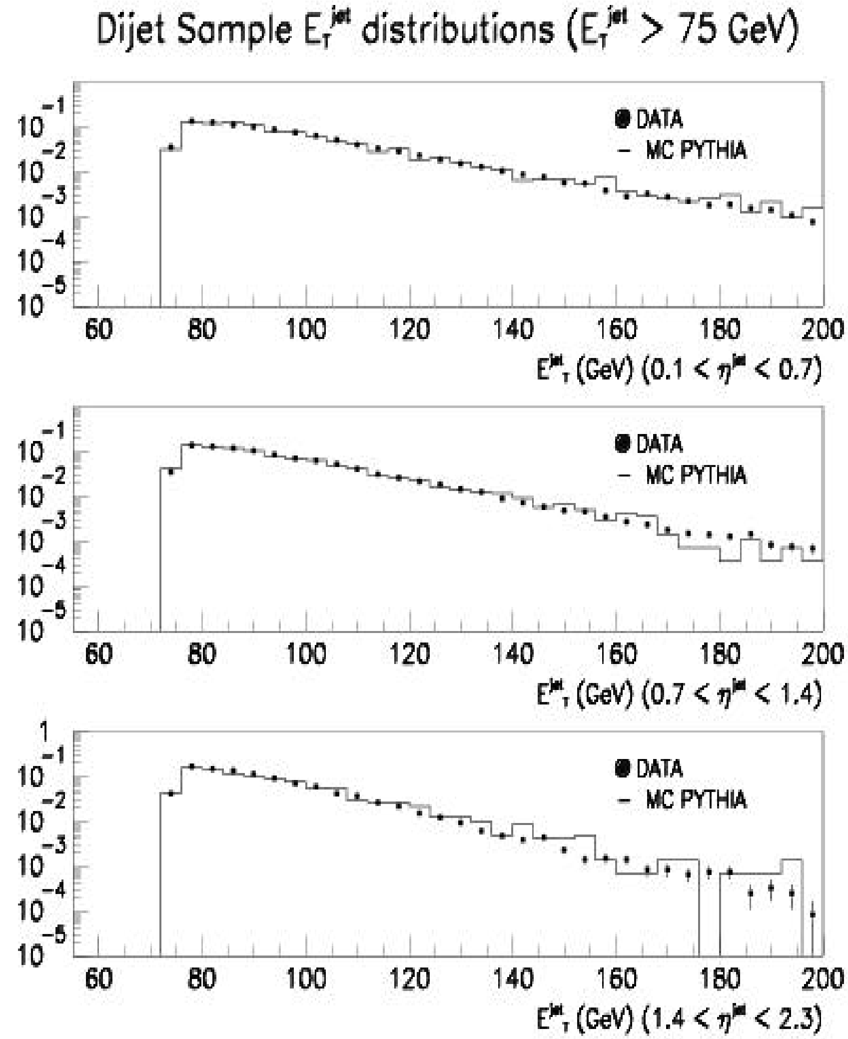
Other cuts (same as ICHEP'02)

$$\frac{\text{Missing } E_T}{\sqrt{E_T}} < 2\ \text{GeV}^{1/2} \qquad |V_Z| < 60\ \text{cm}$$

New Cut against MI : No more than 1 vertex

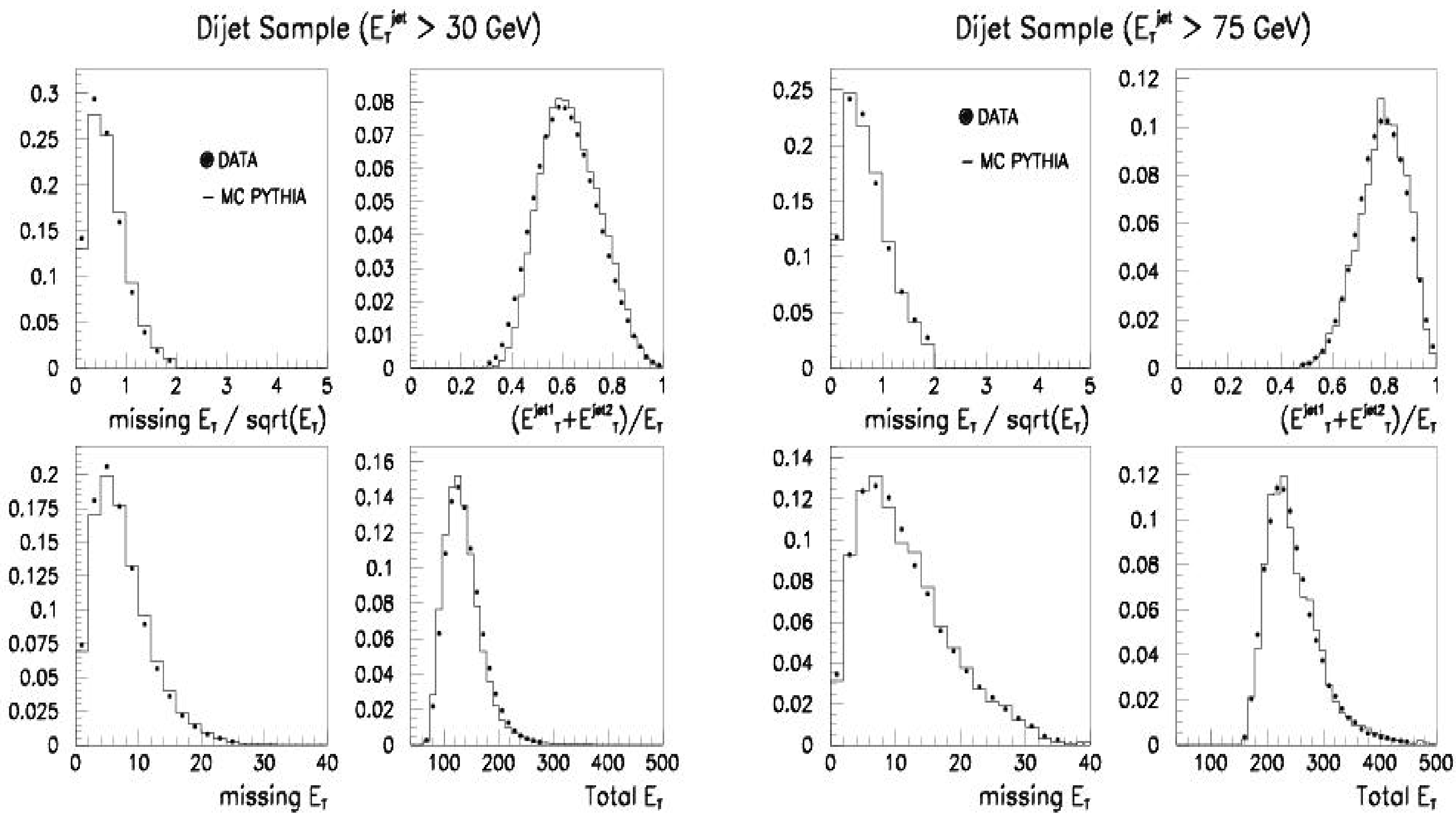
Some Control Plots (I)





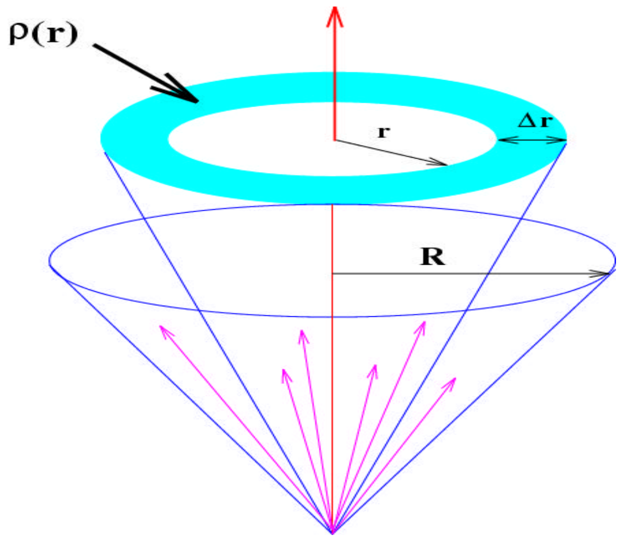
Comparison Data/MC is satisfactory

Some Control Plots (II)

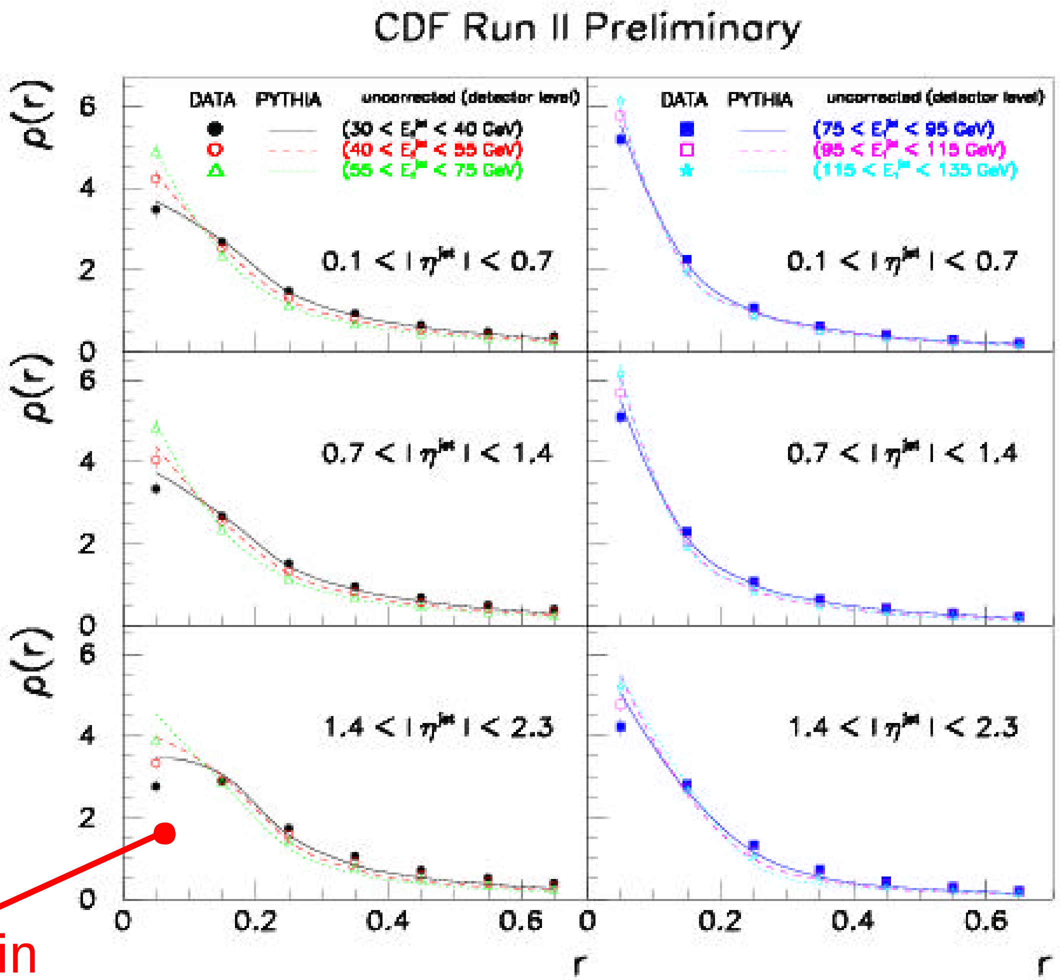


Comparison Data/MC is satisfactory

Differential Jet Shapes CAL



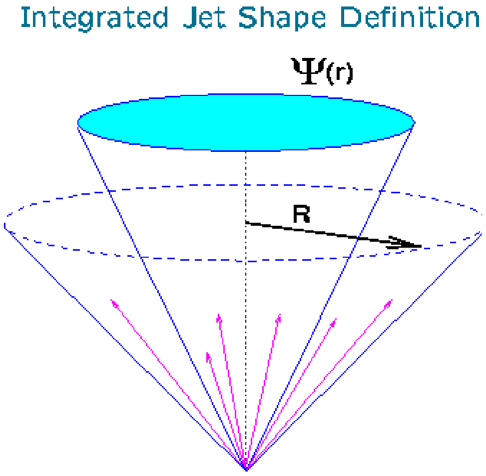
$$\rho(r) = \frac{1}{\Delta r}\frac{1}{N_{jet}}\frac{\sum E_T(r \pm \Delta r/2)}{\sum E_T(0,R)}$$



MC is not describing DATA in
The very forward region….

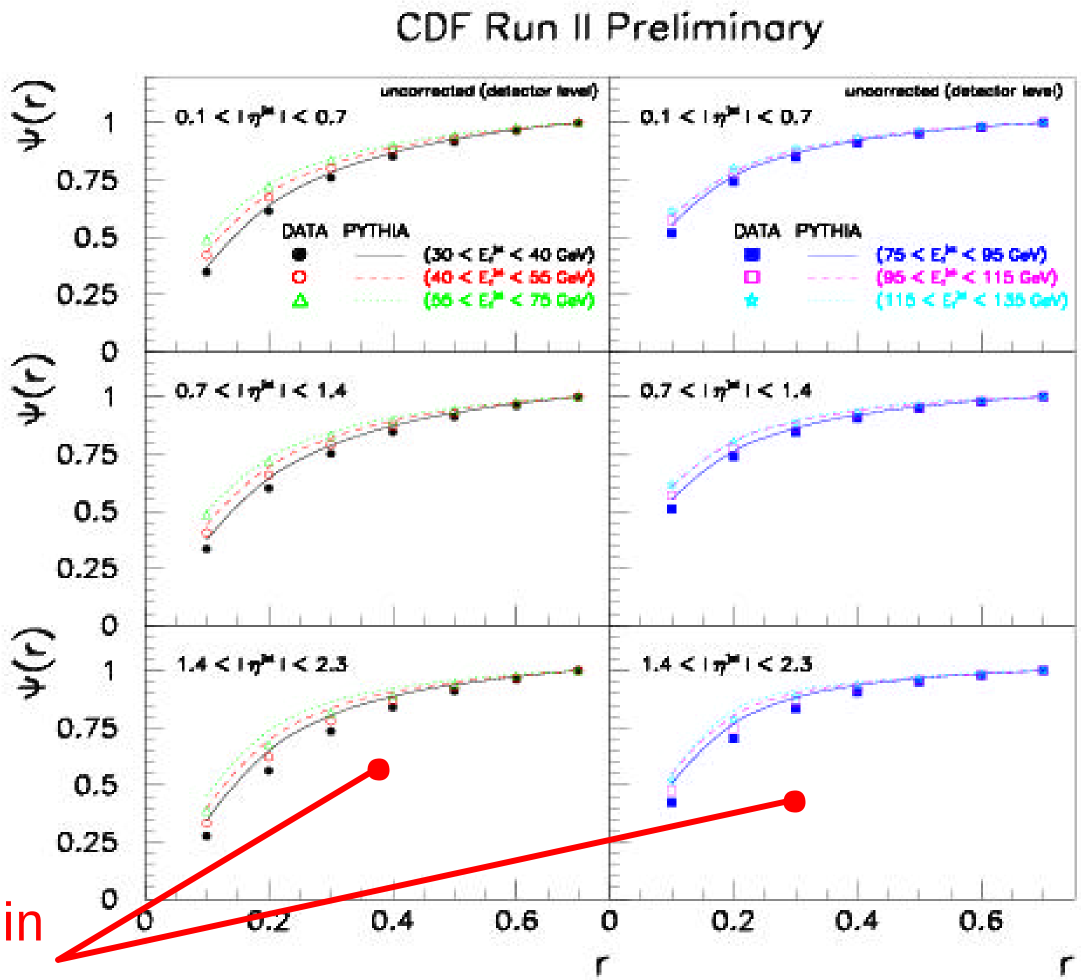
…will need improved shower simulation…

Integrated Jet Shapes CAL



$$\Psi(r) = \frac{1}{N_{\text{jets}}} \Sigma_{\text{jets}} \frac{E_T(0,\ldots}{E_T^{\text{jet}}(0,\ldots}$$

$$\Psi(r = R) = 1$$



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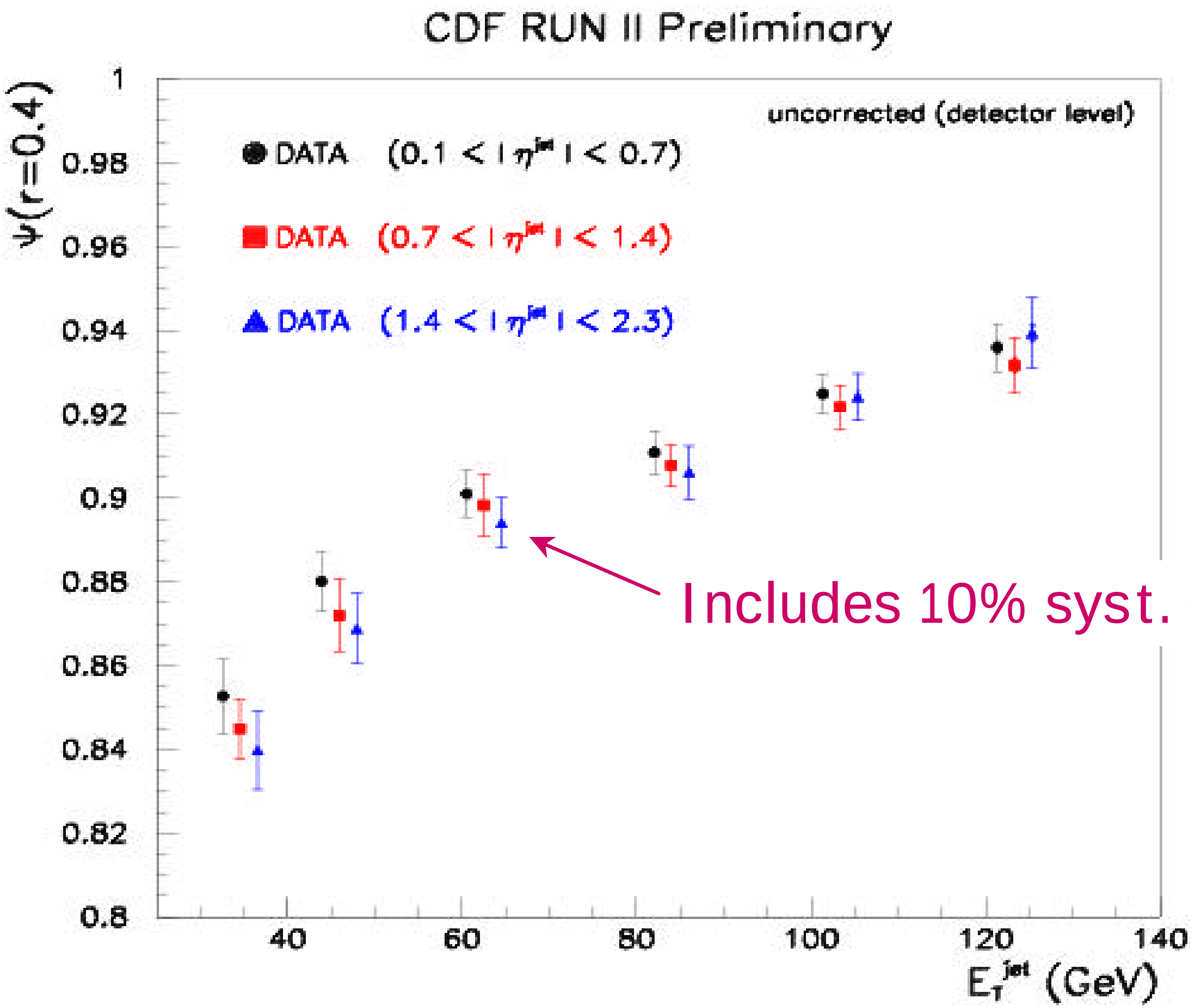
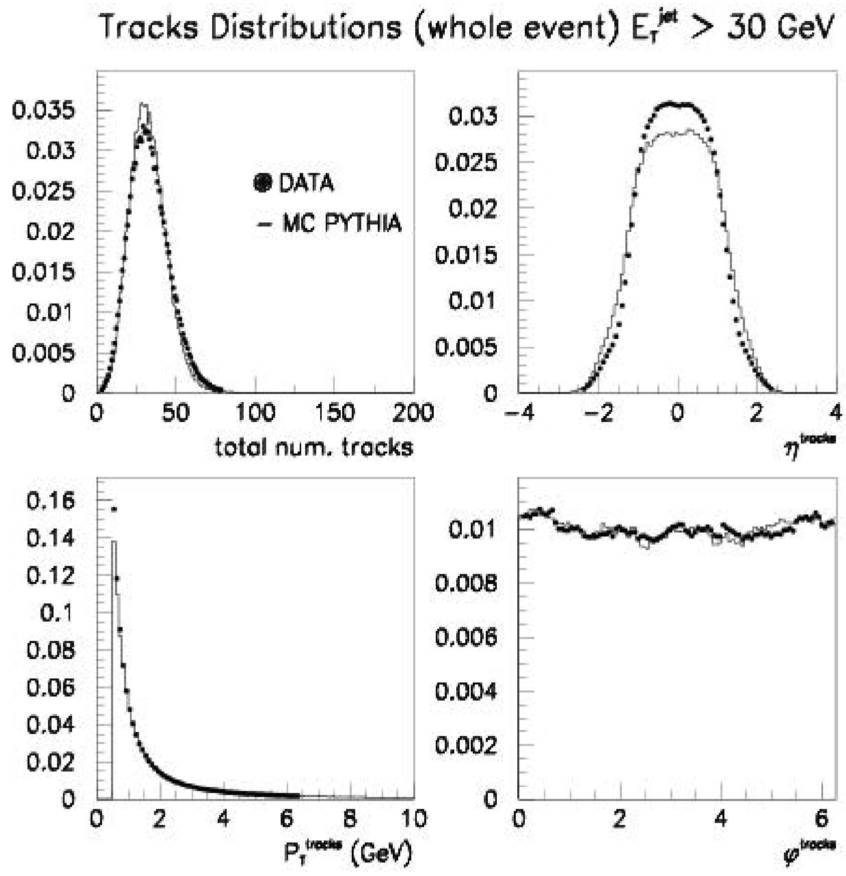
Integrated Jet Shapes CAL

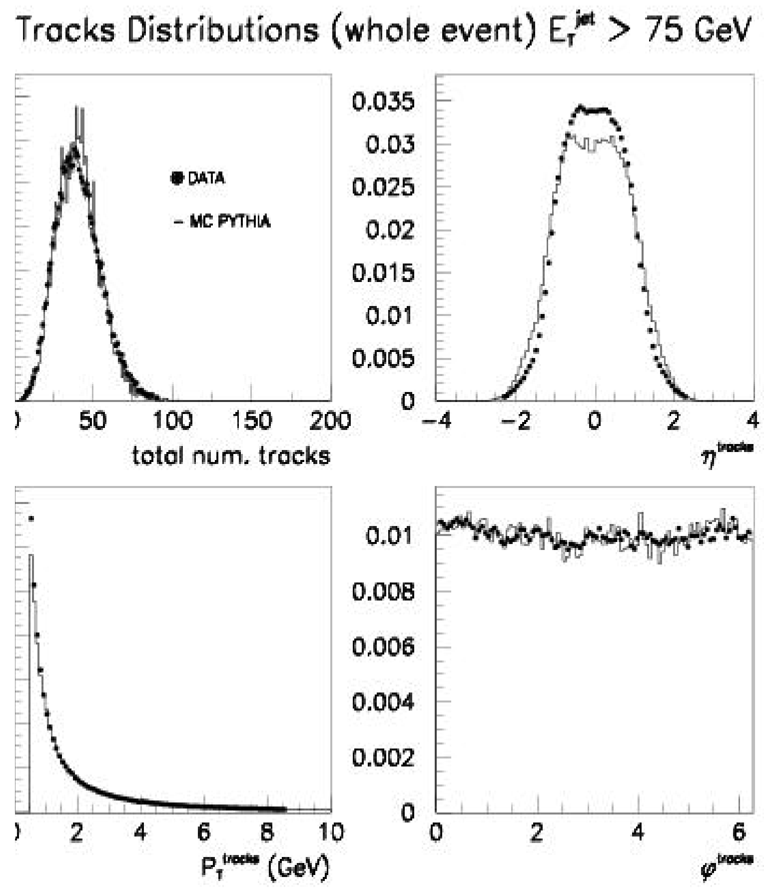


Includes 10% syst. on e-scale

Global Tracking Variables

Default Tracking Collection $500\ \mathrm{MeV} < P_T^{track} < 100\ \mathrm{GeV}$





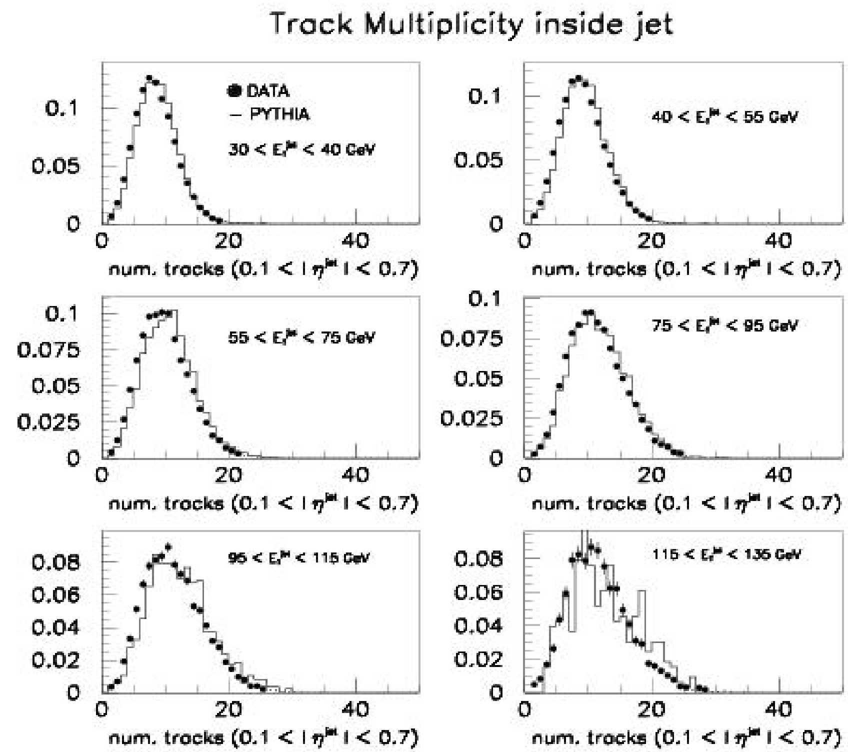
Tracks inside Jets

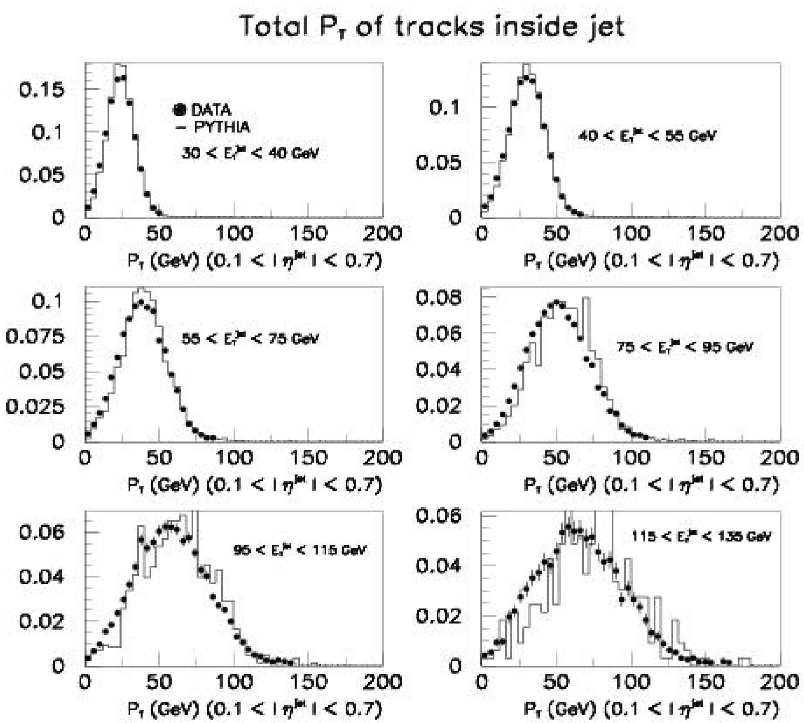
$500\ \mathrm{MeV} < P_T^{track} < 100\ \mathrm{GeV}$

$|\eta^{track}| < 1.0$

$|z^{track} - V_z| < 2\ \mathrm{cm}$

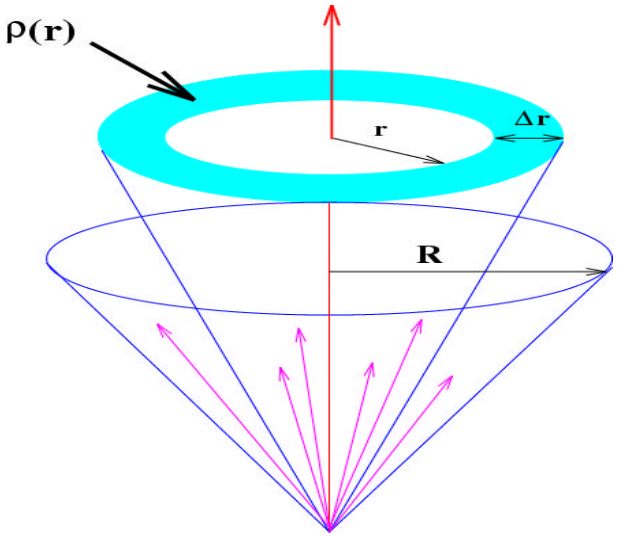
$\Delta R(\mathrm{track - jet}) < 0.7$





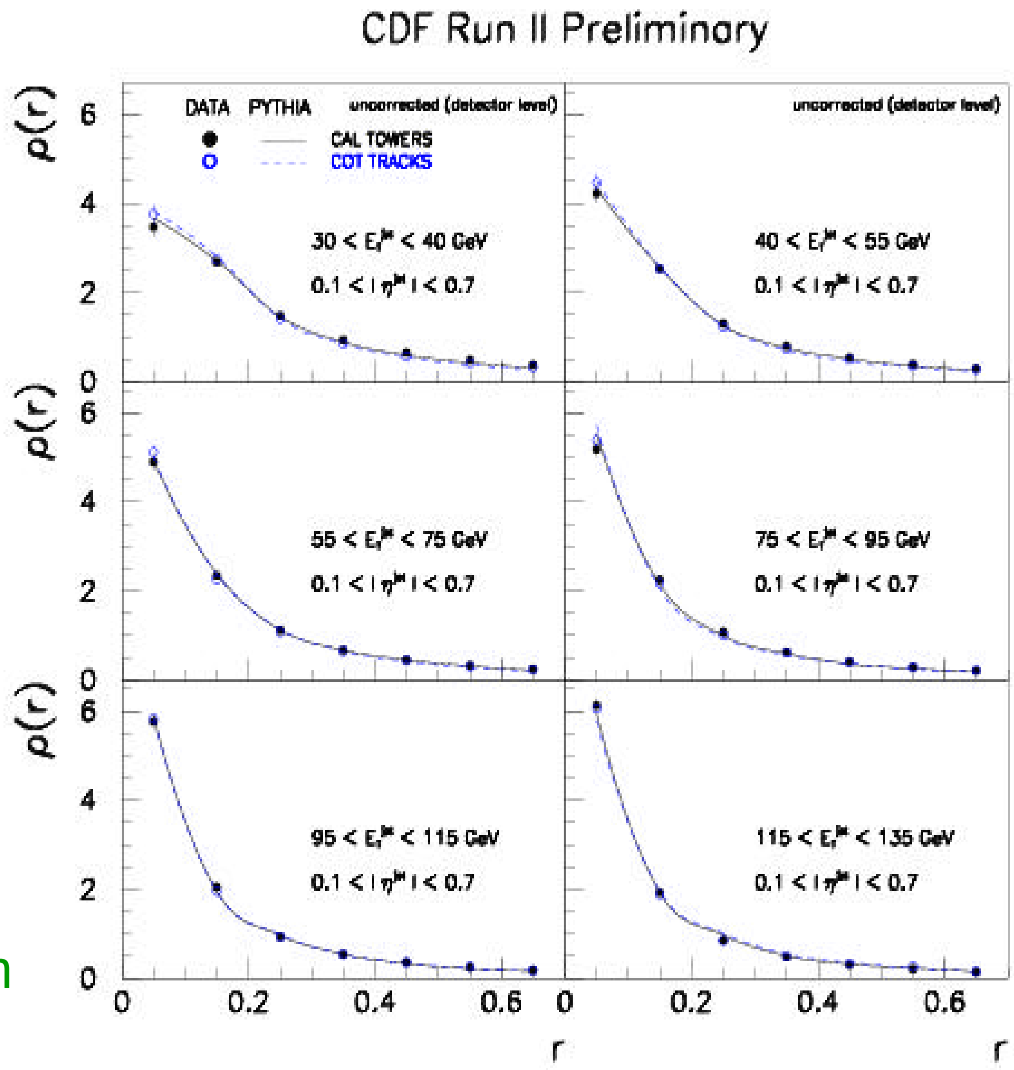
Reasonable *(not perfect)* description of track momenta and multiplicities

Jet Shapes CAL/COT

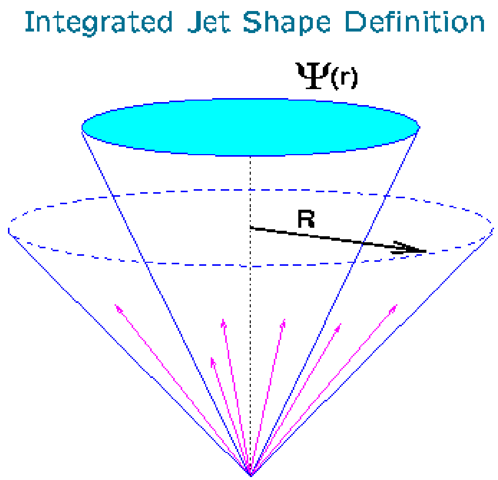


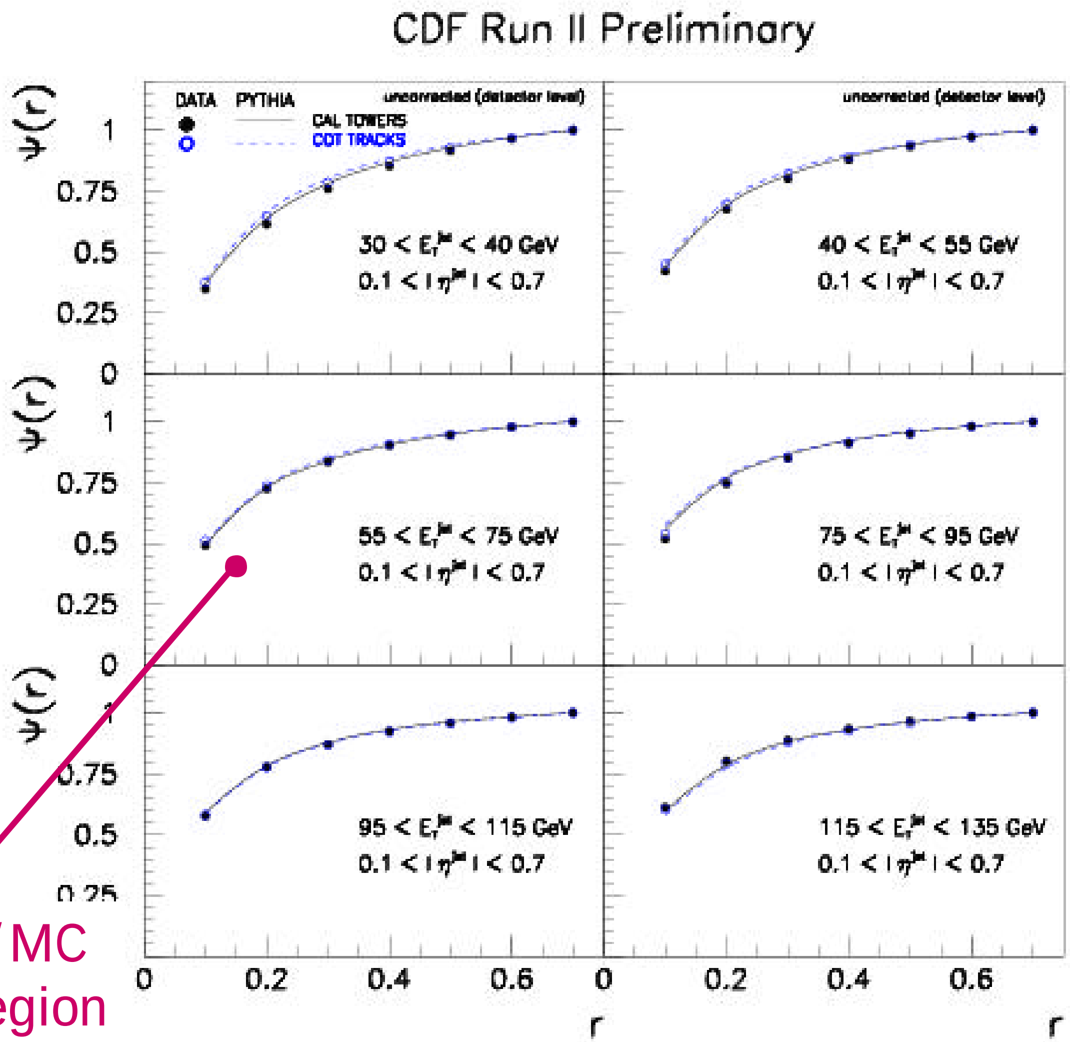
$$\rho(r) = \frac{1}{\Delta r}\frac{1}{N_{jet}}\frac{\sum P_T^{tracks}(r \pm \Delta r / 2)}{\sum P_T^{tracks}(0, R)}$$

Perfect agreement DATA/MC and COT/CAL in central region



Jet Shapes CAL/COT





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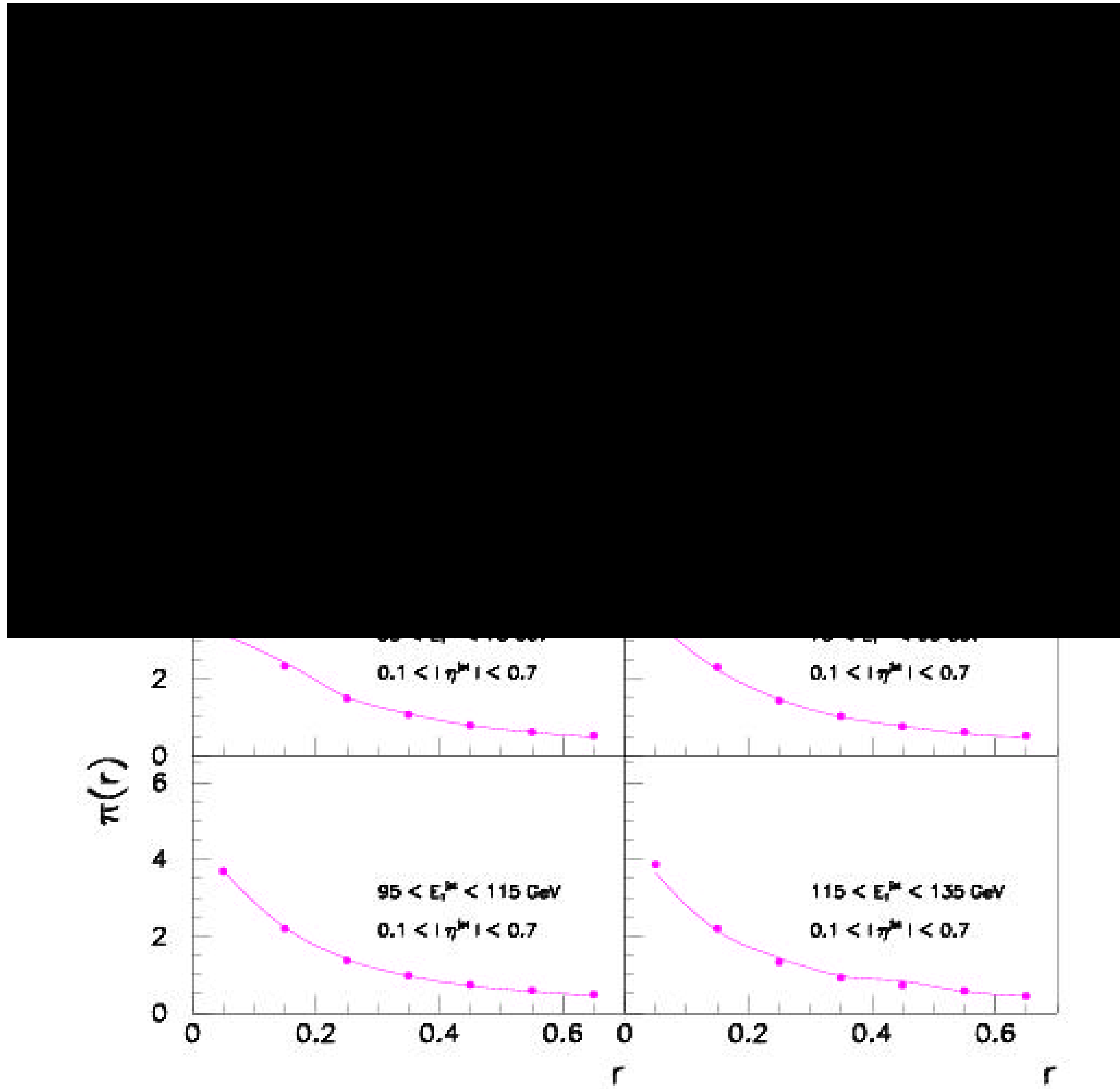

[redacted]
0.1 < |η^jet| < 0.7
0.1 < |η^jet| < 0.7
π(r)
95 < E_T^jet < 115 GeV
0.1 < |η^jet| < 0.7
115 < E_T^jet < 135 GeV
0.1 < |η^jet| < 0.7
0
2
4
6
0
0.2
0.4
0.6
r
r

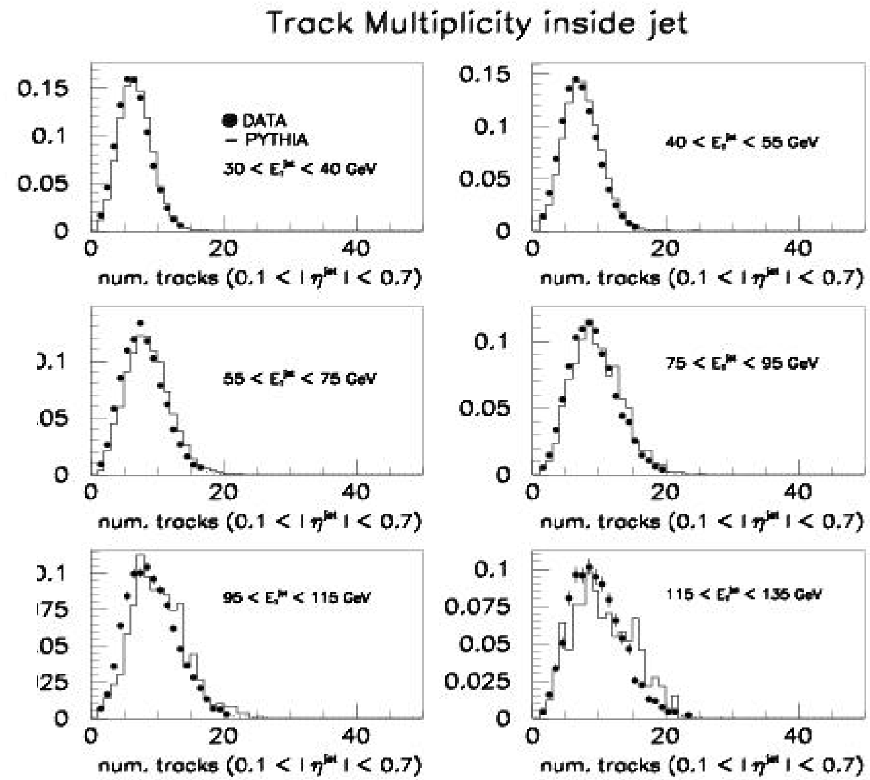
Tracks inside Jets (II)

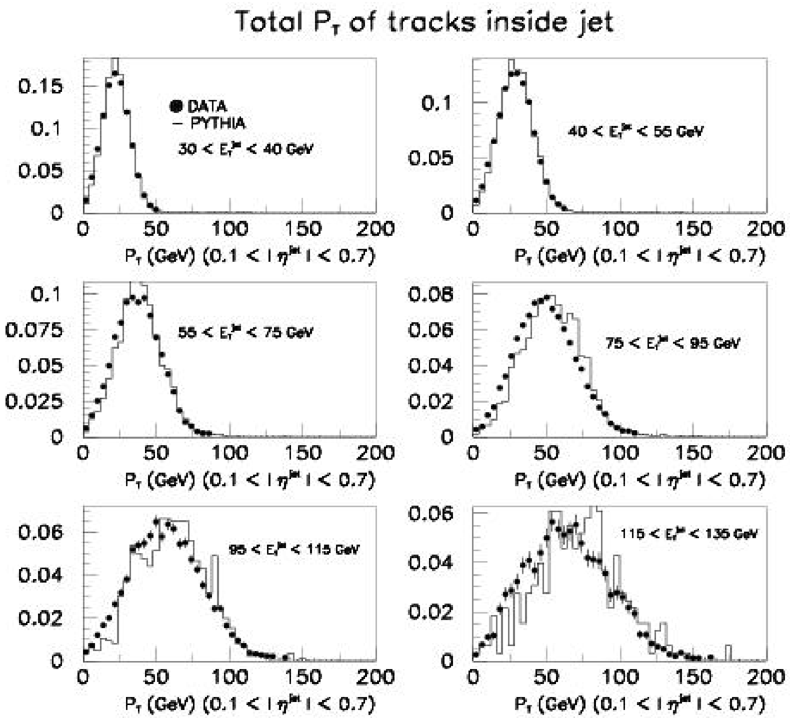
$1\ \mathrm{GeV} < P_T^{track} < 100\ \mathrm{GeV}$

$|\eta^{track}| < 1.0$

$|z^{track} - V_z| < 2\ \mathrm{cm}$

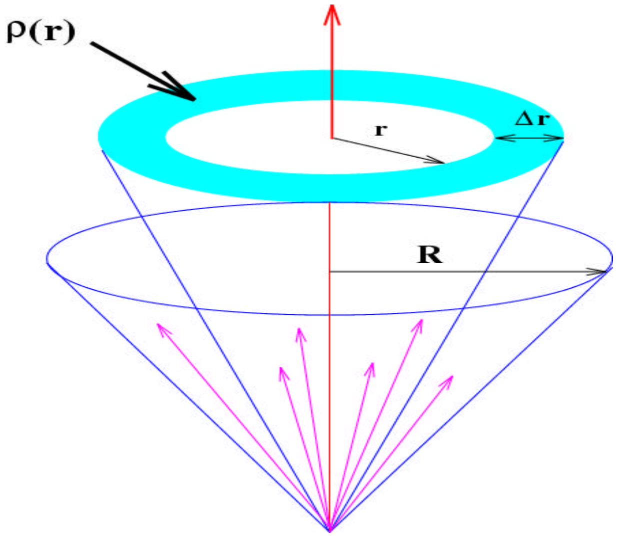
$\Delta R(track\text{ - }jet) < 0.7$





No significant inprovement in the comparison DATA/MC at higher pt

Jet Shapes CAL/COT (II)



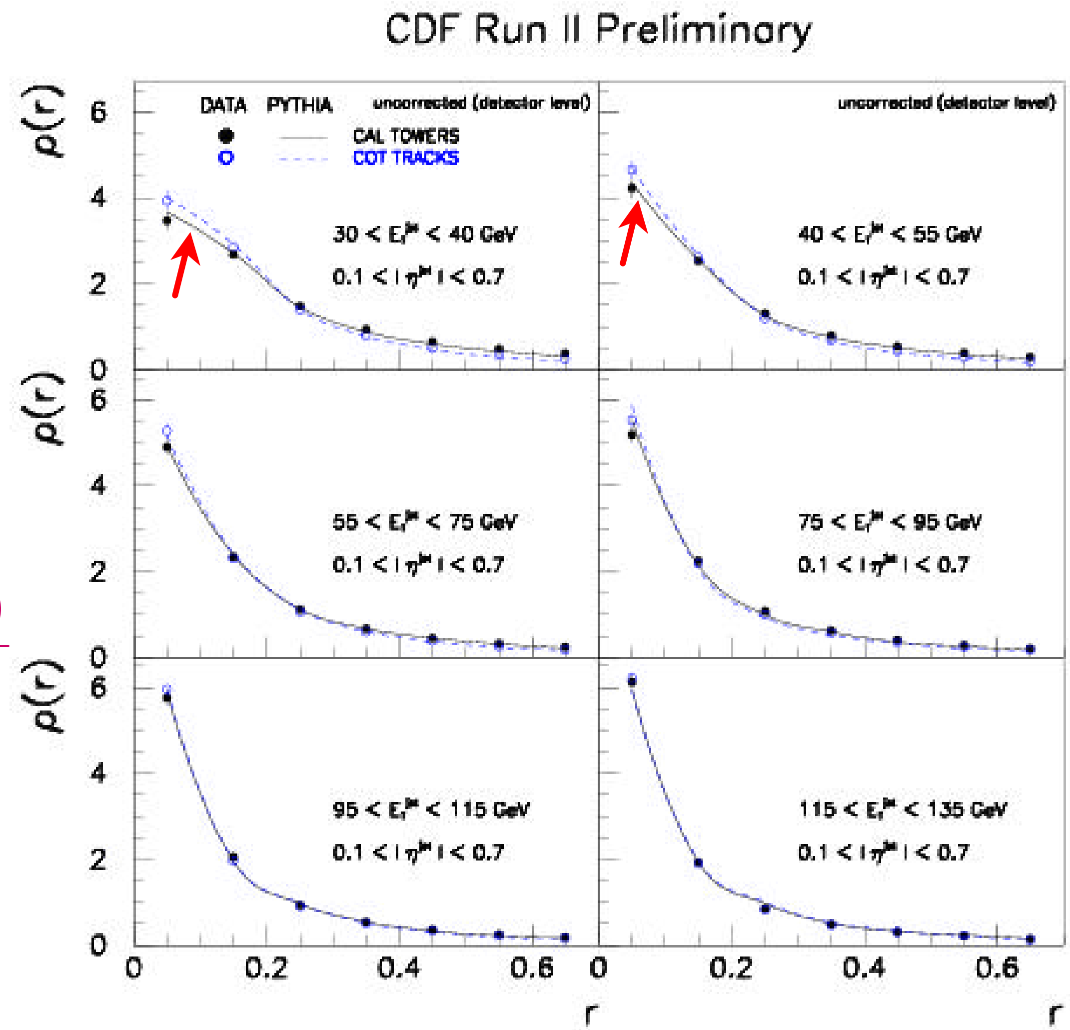
$$\rho(r) = \frac{1}{\Delta r}\frac{1}{N_{jet}}\frac{\sum P_T^{tracks}(r \pm \Delta r/2)}{\sum P_T^{tracks}(0,R)}$$

$$1\ \mathrm{GeV} < P_T^{track} < 100\ \mathrm{GeV}$$

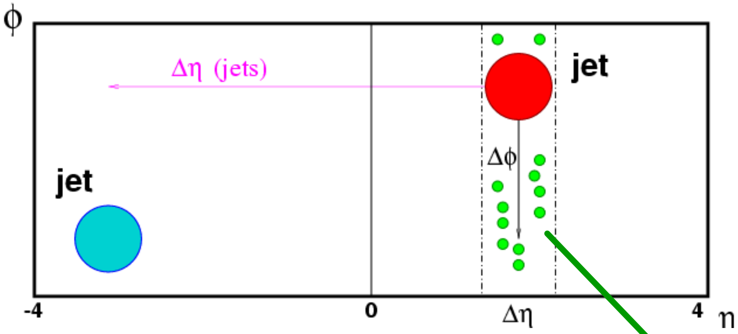
$$|\eta^{track}| < 1.0$$

$$|z^{track} - V_z| < 2\ \mathrm{cm}$$

$$\Delta R(\mathrm{track\text{-}jet}) < 0.7$$



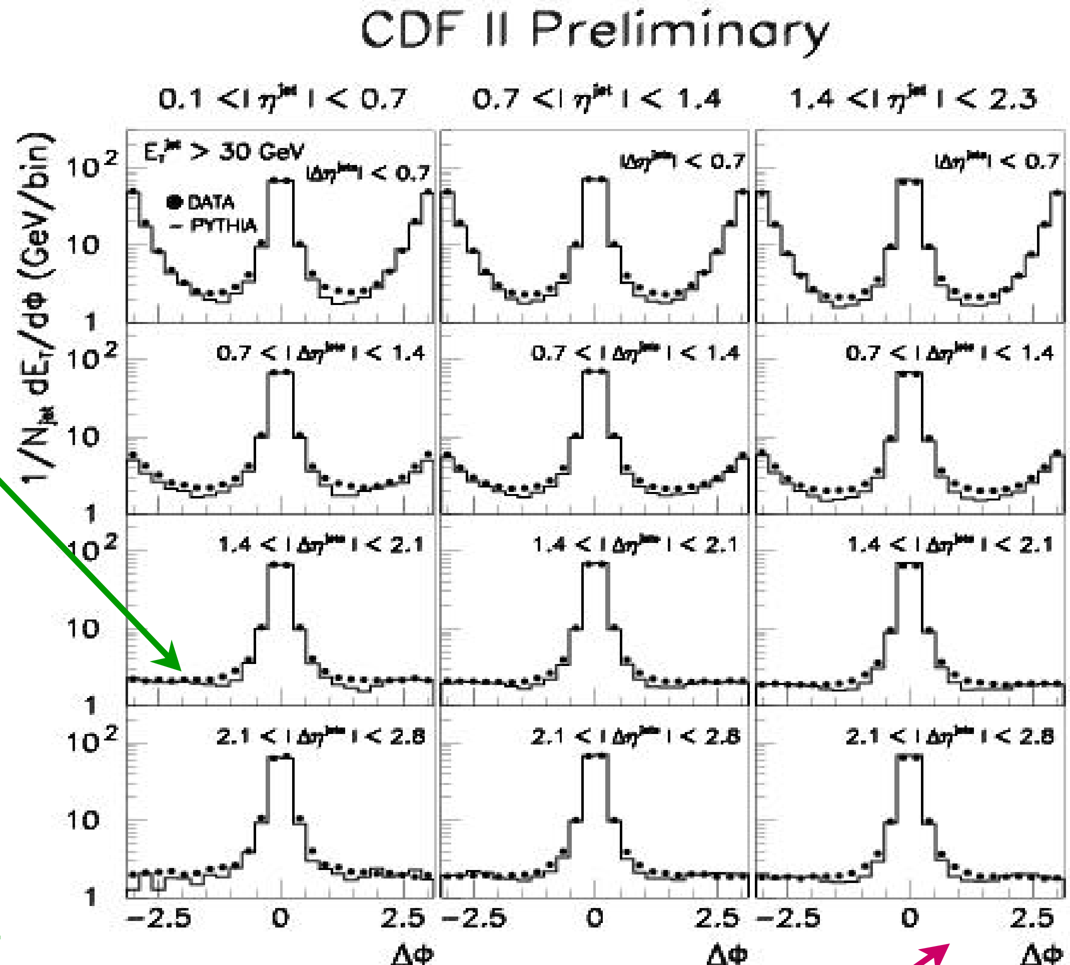
Study of Energy Flows



Dijets ($E_T^{jet} > 30$ GeV)

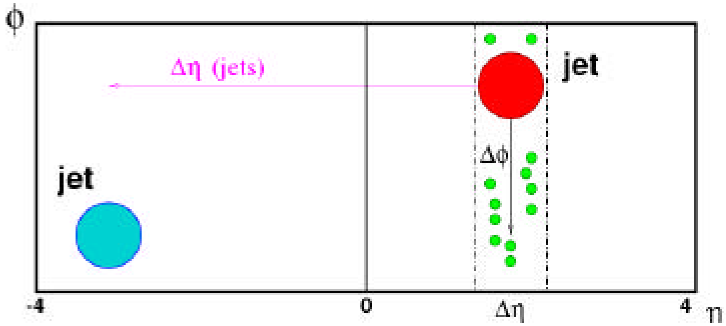
Selecting events with only one primary vertex

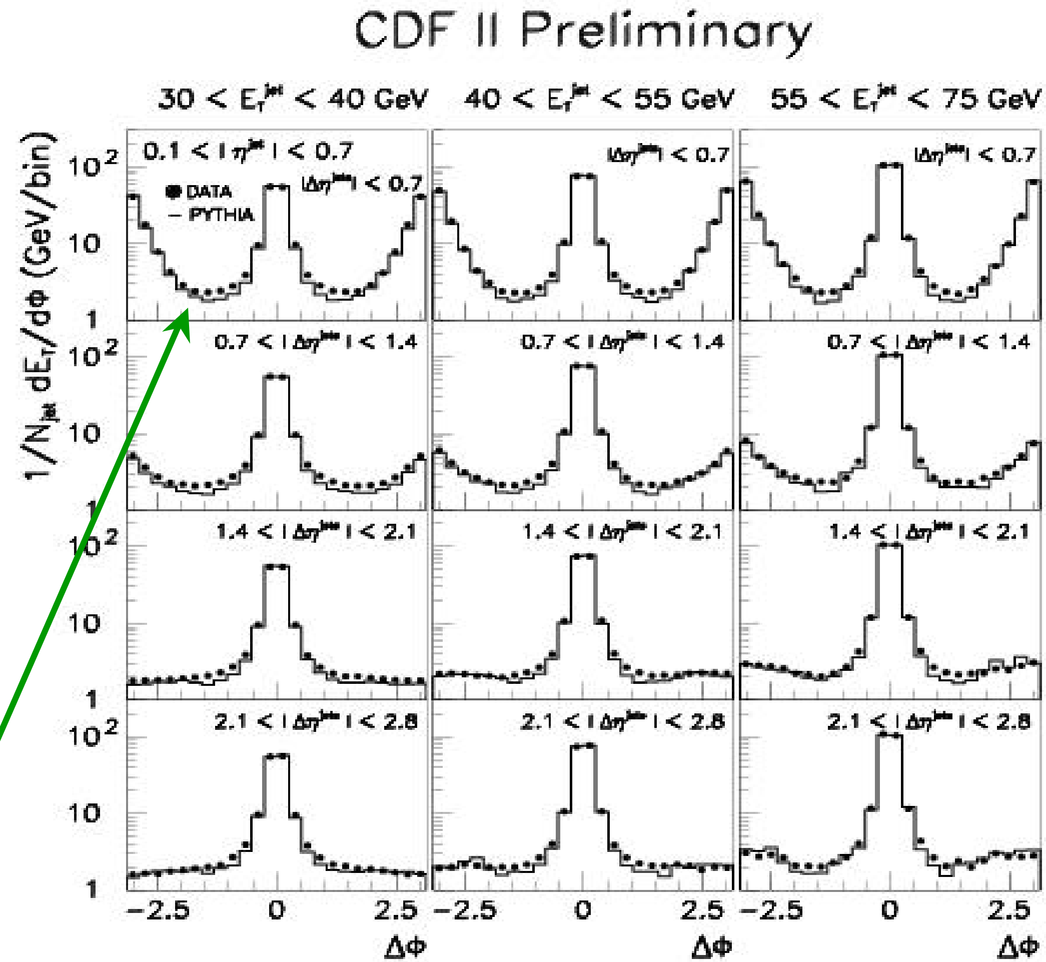
Energy Flows around jets sensitive to Underlying Event and soft gluon radiation



Forward region affected by MC simulation ...

Study of Energy Flows (II)





Just for central jets

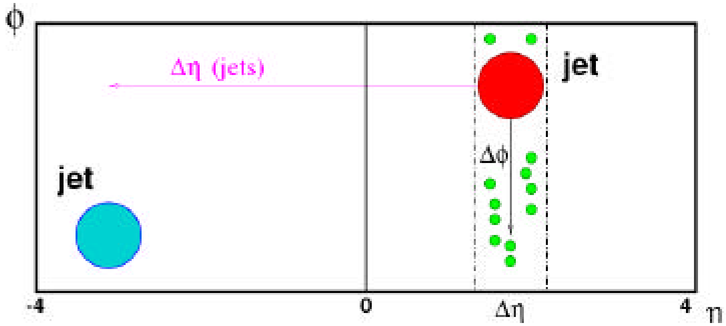
$0.1 < | h | < 0.7$

PYTHIA with Set (A) tuning of underlying event provides a reasonable description (~20% discrepancy in valley)

Systematic 10% e-scale to be done..

Comparison with HERWIG on the way...

Study of Energy Flows (III)



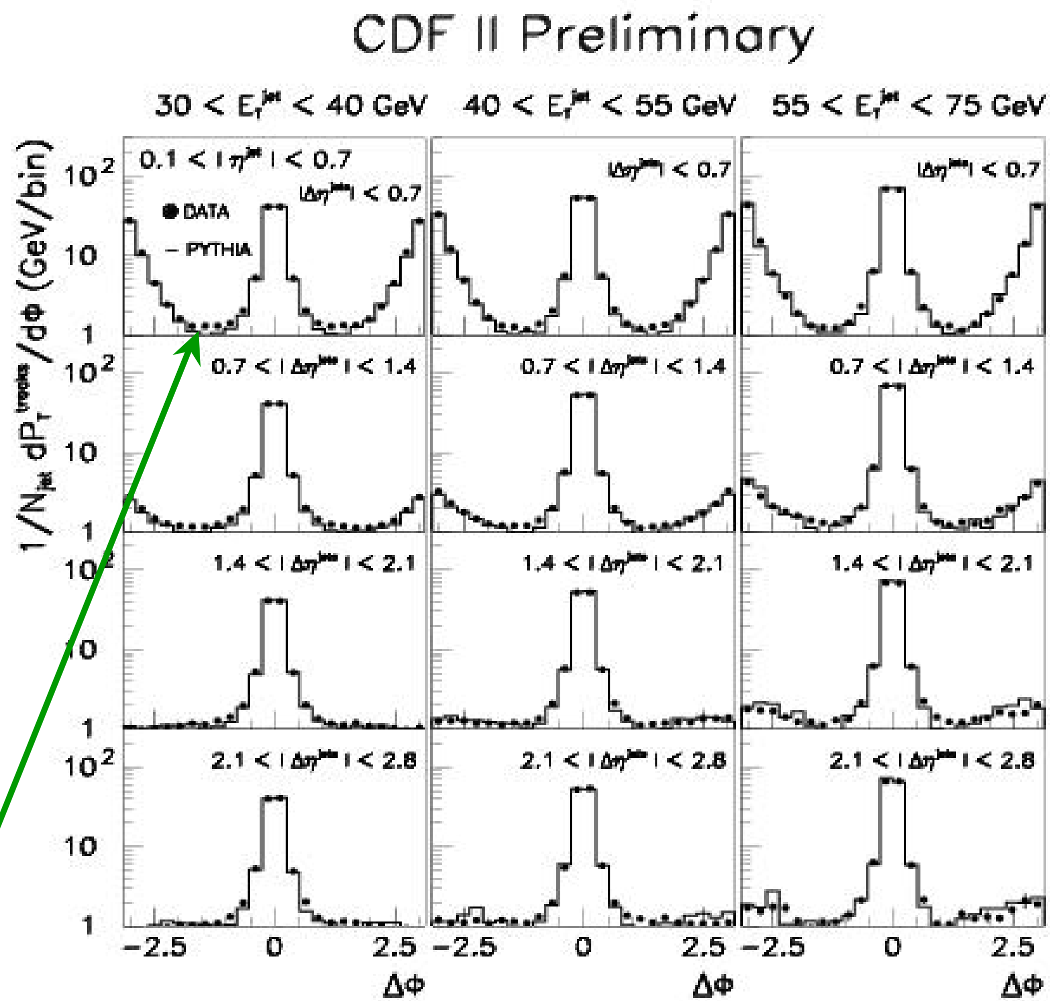
....with tracks..

$$500\text{ MeV} < P_T^{track} < 100\text{ GeV}$$

$$|\eta^{track}| < 1.0$$

$$|z^{track} - V_z| < 2\text{ cm}$$

PYTHIA with Set (A) tuning of underlying event provides a reasonable description (~20% discrepancy in valley)



Summary and Conclusions

- **Results updated with latest version of MC and DATA**
- **Very good agreement in the central region**
- **Absolute corrections not applied until MC is understood**
- **Forward Region affected my MC simulation**
- **PYTHIA describes both the jet shape and hardness and provides reasonable underlying event structure**
- **….Include HERWIG in the picture as soon as we can**